P.1

Real Numbers

Real Numbers: any number that can be written as a decimal.

Ex. -8, 0, 1.75, 2.33, $0.\overline{36}$, $\frac{8}{5}$, $\sqrt{3}$, π

Subsets of real numbers:

Natural numbers (counting): {1, 2, 3, …}

Whole numbers: {0, 1, 2, 3,…}

Integers: {…-3, -2, -1, 0, 1, 2, 3,…}

Rational number: a number that can be written as a ratio or fraction

$$\{\frac{a}{b} \mid \text{a, b are integers b } \neq 0\}$$

Ex.

$\frac{7}{4} = 1.75$ terminating

$\frac{4}{11} = 0.3636... = 0.\overline{36}$ infinitely repeating

A real number is irrational if it is not rational. (Infinitely nonrepeating)

Ex.

$\sqrt{3}$ = 1.73205… and π = 3.141592…

Order and Interval Notation

The set of real numbers is ordered. This means we can compare any two real numbers that are not equal using inequalities and say one is "less than" or "greater than" the other.

Trichotomy Property

Let *a* and *b* be any two real #'s. Exactly one of the following is true.

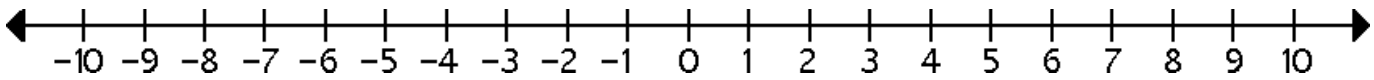
$a < b, \quad a = b, \quad$ or $\quad a > b.$

Inequalities can be used to describe intervals.

Ex.

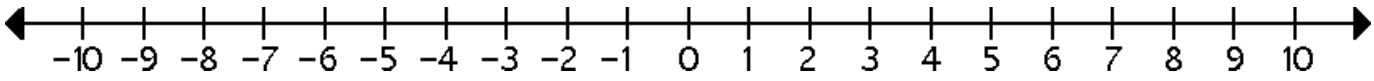
$x < 3$ Interval notation

$(-\infty, 3)$



$-1 < x \leq 4$ Interval notation

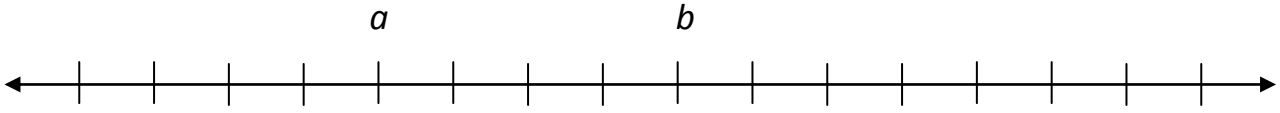
$(-1, 4]$



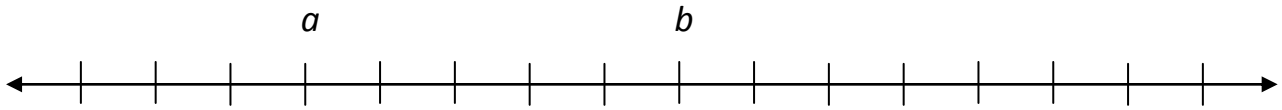
Bounded Intervals

$[a,b]$ closed $a \leq x \leq b$

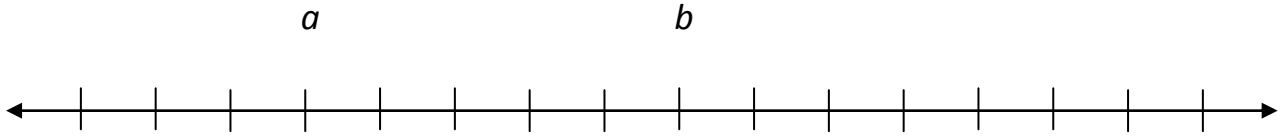
(a,b) open $a < x < b$



$[a,b)$ half-open $a \le x < b$

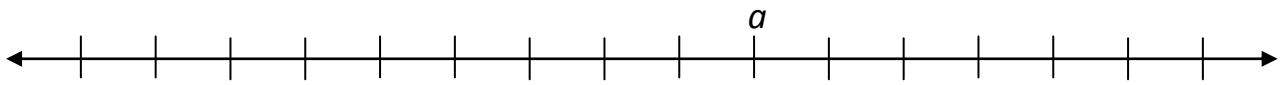


$(a,b]$ half-open $a < x \le b$

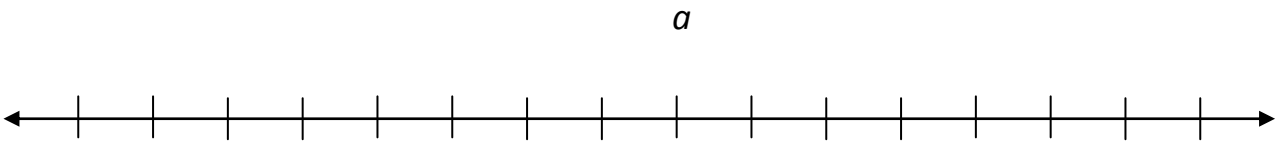


Unbounded Intervals

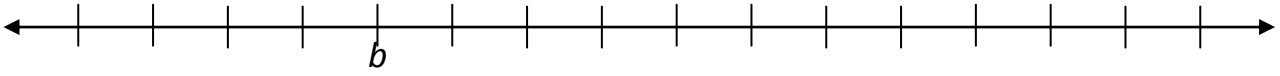
$[a,\infty)$ closed $x \ge a$



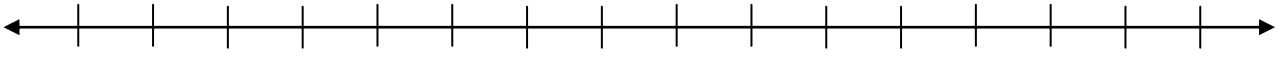
(a,∞) open $x > a$



$(-\infty,b]$ closed $x \le b$



$(-\infty,b)$ open $x < b$



One end point *a* or *b.*

Basic Properties of Algebra

Commutative Property

Addition: $u + v = v + u$

Multiplication: $uv = vu$

Associative Prop.

$(u + v) + w = u + (v + w)$

$(uv)w = u(vw)$

Identity Prop.

Addition: $u + 0 = u$

Mult.: $u \cdot 1 = u$

Inverse Prop.

$u + (-u) = 0$

$u \cdot \frac{1}{u} = 1 \quad u \neq 0$

Distributive Prop.

$u(v + w) = uv + uw$

$(u + v)w = uw + vw$

$u(v - w) = uv - uw$

$(u - v)w = uw - vw$

Properties of the Additive Inverse

1. $-(-u) = u$

2. $(-u)(v) = (u)(-v) = -(u)(v)$

3. $(-u)(-v) = uv$

4. $(-1)u = -u$

5. $-(u + v) = -u + -v$

Ex.

$-(-3) =$ _____

$-(7 + 9) =$ _____ + _____ = _____

$(-6)(-7) =$ _____ • _____ = _____

$(-4)3 = 4($____$) = -($____ • ____$) =$ _____

Exponential Notation

$a^n = a \cdot a \cdot ... a \quad n \text{ factors}$

a *base*
n exponent
a^n *a to the nth power*

Properties of Exponents

1. $u^m u^n = u^{m+n}$
2. $\frac{u^m}{u^n} = u^{m-n}$
3. $u^0 = 1$
4. $u^{-n} = \frac{1}{u^n}$
5. $(uv)^m = u^m v^m$
6. $(u^m)^n = u^{mn}$
7. $\left(\frac{u}{v}\right)^m = \frac{u^m}{v^m}$

Scientific Notation

Any positive number can be written in scientific notation.

$c \text{ x } 10^m, where \ 1 \le c < 10$ and *m* is an integer.

Ex.

93,000,000 = 9.3 x 10^7

0.000 000 000 000 053 = 5.3 x 10^{-14}